

**MOLDED PANELS HAVING A SOFT PAD ARMREST****Technical Field**

The present invention relates to molded panels comprising a rigid substrate, a cover layer, and a  
5 localized composite pad for use in automotive interiors, and to a method for making the same.

**Background Art**

Automotive interior molded panel components such as automotive door trims, rear side trims, rear  
10 parcel shelves, etc. are typically provided with a layered structure comprising a core layer, or substrate, having a certain rigidity and a skin, or cover, layer having an ornamental or attractive surface texture which is bonded to the surface of the core layer. In order to  
15 minimize the time and labor required to manufacture these molded panels interior components, resort has been made to integrally assembling the rigid substrate and the cover layer of these molded panels according to a one-step forming process wherein the cover layer is  
20 shaped and secured to the rigid substrate during the forming of the rigid substrate. This is typically done by inserting a cover-skin material between a first and second mold of a molding tool; introducing resin into the molding tool; and solidifying the resin to form a  
25 molded rigid substrate with the cover material secured thereto. The resin can be introduced into the molding tool using two suitable molding processes, injection molding and low pressure molding (LPM).

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5 It is often desirable for these automotive molded panels to have a soft-touch to the vehicle occupant. Up until now, there has not been a suitable one-step method for forming molded panels having a soft touch.

Accordingly, it would be desirable to provide a one-step method for making a soft-touch molded panel that can be done inexpensively and without requiring a substantial amount of time and labor. It would also be  
10 desirable to manufacture a soft touch molded panel, i.e., via a low pressure molding or injection molding process method.

#### Disclosure Of Invention

15 The present invention relates to a method for forming a molded panel comprising a rigid substrate, a cover layer, and a localized composite pad. The method comprises providing a molding tool having a first mold and a second mold, the first mold having a cavity; inserting a cover layer between the first mold and the  
20 second mold; placing a composite pad comprising an impregnable layer and a non-impregnable layer in the cavity of the first mold, wherein the non-impregnable layer is facing the second mold and the impregnable layer is abutting the first mold; introducing resin into  
25 the molding tool; and solidifying the resin to form the molded panel whereby the non-impregnable layer of the composite pad is located adjacent the cover layer.

Use of the composite pad allows the molded panel to be manufactured in a one-step method. During  
30 the introduction of the resin into the molding tool and during the solidifying of the resin to form the molded

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panel, the resin is allowed to flow through the impregnable layer of the composite pad. If the pad was formed of only non-impregnable elastomeric material, the resin would flow over the non-impregnable pad and  
5 between the pad and the cover layer. Also, the resin could possibly flow around the non-impregnable pad or cause the pad to be moved from its place. To overcome this problem, prior art processes that use a pad formed only of non-impregnable material employ the additional  
10 steps of bonding the elastomeric pads to the cover layer, and preforming the cover layer to the molded shape, prior to introducing the resin.

Another disadvantage to having the resin flow around the pad is that the structural integrity of the  
15 molded panel is compromised since the substrate does not extend below the pad. In the present invention, the molded panel has a portion that extends through the impregnable layer.

The above objects and other objects, features,  
20 and advantages of the present invention are readily apparent from the following detailed description of the best modes for carrying out the invention when taken in connection with the accompanying drawings.

#### **Brief Description Of Drawings**

25 Figure 1 is a side view of a molded panel in accordance with the present invention;

Figure 2 is a sectional view of the molded panel of Figure 1 taken along line 2-2;

30 Figure 3 is a side view of a component of the molded panel of Figure 1; and

Figures 4a-4d illustrate the general method for making the molded panels of the present invention.

**Best Mode For Carrying Out The Invention**

Figure 1 illustrates a molded door panel 10 of the present invention. The door panel 10 comprises a rigid substrate 12, a cover layer 14, and a composite pad 20 there between. The molded panel 10 has a hardness of about 45-70 Shore A, more preferably about 50-65 Shore A, and most preferably about 55-62 Shore A, when measured according to ASTM No. D2240 along a line that intersects the composite pad 20. The door panel 10 includes an armrest portion 24 about halfway between the top and bottom edges of the door panel 10. The armrest portion 24 is formed as a rounded horizontal shelf.

The rigid substrate 12 is preferably between 1.0 and 4.5 mm in thickness, more preferably between about 2 and about 3.25 mm in thickness, and most preferably between about 2.5 to about 2.8 mm in thickness. The molded rigid substrate 12 can be made of any suitable thermoplastic or thermoset resin. Suitable resins include, but are not limited to, polypropylene, polyethylene, polyvinylchloride, ABS, and Dylark®.

The cover layer 14 secured to the rigid substrate 12 and the composite pad 20 preferably has a thickness between about 0.3 to about 4 mm, more preferably between about 0.4 and about 2.5 mm, and most preferably between about 1 to about 2.5 mm. The cover material may be a suitable type of cover material. Preferably, the cover material comprises a skin layer consisting of a cloth, non-woven fabric, vinyl, TPO, or the like, and a laminated cushioning layer, such as a

layer of polyurethane or olefin foam, lined to the reverse surface, or underside of the skin layer.

The composite pad 20, as best shown in Figure 2, comprises an impregnable layer 30 and a non-  
5 impregnable layer 32. The layers 30 and 32 are bonded to each other, preferably by a suitable adhesive, such as the spray adhesives made by 3M. The layers 30 and 32 may also be bonded together by flame lamination.

The composite pad 20 can be of any suitable  
10 thickness depending upon the design and structure of the molded door panel 10. Preferably, the composite pad 20 has a thickness from about 5 and 30 mm, more preferably from about 7 and 15 mm, and most preferably from about 8 and 13 mm. The composite pad 20 preferably has a  
15 hardness of about 35-75 Shore A, more preferably of about 45-60 Shore A, and most preferably about 50-55 Shore A, when measured according to ASTM No. D2240.

As with the thickness of the composite pad 20, the thickness of each layer 30 and 32 may vary depending  
20 upon the design and structure of the molded door panel 10. Preferably, the impregnable layer 30 has a thickness of at least the thickness of the rigid substrate 12, and more preferably has a thickness that is greater than the thickness of substrate 12.  
25 Preferably, the impregnable layer has a thickness of from about 1 to about 25 mm, more preferable about 3 to about 15 mm and most preferably from about 5 and 10 mm. The non-impregnable layer 32 preferably has a thickness of from about 1 and 25 mm, more preferably from about 3  
30 and 8 mm, and most preferably from about 5 and 10 mm.

The impregnable layer 30 is a reticulated, or porous, pad. The impregnable layer 30 can be made of any suitable material, and preferably is made of

resinous material. Suitable resinous materials include, but are not limited to, polypropylene, polyethylene, and polyurethane. The impregnable layer preferably has a pore density of between about 1 to about 100 pores per inch, and more preferably between about 10 to about 60 pore per inch.

The impregnable layer 30 preferably has an CLD (compression load deflection) of between about 0.35 to 0.52 psi. The impregnable layer 30 preferably has a foam density of between about 1.5 to about 2.5 pounds per cubic foot (pcf), and more preferably between about 1.75 to about 2.25 pounds per cubic foot (pcf).

The non-impregnable layer 32 is made of any suitable elastomeric foam-type material. The foam type material is a non-reticulated, opened or closed-cell material, that is impermeable to liquified resin. Suitable materials include, but are not limited to, polypropylene, polyethylene, and polyurethane. The non-impregnable layer 32 is made of such a material that it preferably has an indentation load of from about 5 to about 100 pounds, more preferably from about 7.5 to about 80 pounds, and most preferably from about 10 to about 60 pounds. The material used to form the layer of non-impregnable material preferably has a foam density of from about 1 to about 6 pcf, and more preferably from about 1.25 to about 4 pcf, and most preferably from about 1.6 to about 2.5 pcf.

The molded panel 10 is formed via a one-step molding process. The general process for forming the molded panel 10 of the present invention is illustrated in Figure 3. A molding tool 40 comprising a first mold 42 and a second mold 44 is provided. The first mold 42 and the second mold 44 include surfaces which cooperate

to define the general shape of the molded panel 10. The first mold 42 includes a cavity 48 for receipt of the composite pad 20 during the molding of the molded panel 10. The composite pad 20, when received in the cavity 48 of the first mold 42, is positioned such that the non-impregnable layer 32 is facing the second mold 44 with the impregnable layer 30 facing and contacting the first mold 42. This enables the impregnable layer 30 to be spaced from the cover material 14 of the molded panel 10 when the molded panel is formed in the non-impregnable layer 32 to be contacting the cover material 14 when the molded panel 10 is formed. The cavity 48 has a depth that is less than the thickness of the impregnable layer 30 so that, when the pad 20 is received in the cavity 48, a portion of the impregnable layer 30 of the pad extends out of the cavity 48 to enable resin to flow into the impregnable layer 30 in the cavity, as will be explained in more detail below.

The cover material 14 is placed between the first and second molds 42 and 44. The composite pad 20 is placed in the cavity 48 of the first mold 42. One or both of the first and second molds 42 and 44 are moved towards the other mold to close the molding tool 40. As will be explained in more detail below, depending upon the particular molding process, resin 47 is introduced into the molding tool either just before or just after the molding tool is closed. The resin is a resin that is used to form the rigid substrate 12. The resin is housed in a hopper or extruder 50 and is delivered into the molding tool 40 through a barrel 52 in the first mold 42. The temperature of the barrel during the molding process, and thus, during delivery of the resin to the tool 40, is between about 350-550°F. The

temperature of the molds 42 and 44 during the molding process is between 50-90°F.

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5 The resin, once in the molding tool 40, is then solidified to form the rigid substrate 12 of the molded panel 10. As the rigid substrate 12 is formed, the cover material is secured to the rigid substrate and the non-impregnable layer 32 of the composite pad 20 by the formation of a chemical or mechanical bond or both, between the cover material 14 and the rigid substrate 12 and the composite pad 20. During this process, the resin is allowed to flow into the cavity 48 from at least one of the sides of the impregnable layer 30 of the pad 20 through at least some of the pores of the impregnable layer 30 and solidify throughout the pores of the impregnable layer. No resin extends into the non-impregnable layer 32. Thus, the substrate 12 has portions that (i) extend throughout the pores of the impregnable layer 30, and (ii) adjacent to the sides of the impregnable layer.

20 The resin for forming the rigid substrate 12 can be introduced into the molding tool 40 by either low pressure molding or injection molding. If the resin is introduced according to the low pressure molding process, the resin is introduced into the molding tool 40 under a pressure of between about 500 to about 1000 psi, more preferably between about 600 to about 900 psi, and most preferably between about 700 to about 800 psi. The resin preferably has a melt flow rate of about 40 to about 100. The resin is introduced into the molding tool 40 when the molds 42 and 44 are spaced about 3/4 of an inch apart from each other. The tool 40 is then completely closed to allow the resin to solidify.



If the resin is introduced according to the injection molding process, the resin is introduced into the molding tool 40 under a pressure of between about 1100 to about 1600 psi, more preferably between about 1200 to about 1500 psi, and most preferably between about 1200 to about 1400 psi. The resin preferably has a melt flow rate of about 10 to about 100. The resin is introduced into the molding tool 40 when the molds 42 and 44 are completely closed.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.